

HIGH TEMPERATURE PROPERTIES ZRC-STRENGTHENED CO-BASED AND FE-BASED CAST SUPERALLOYS

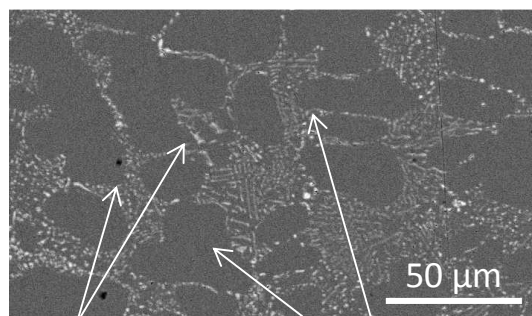
Patrice Berthod, I.J.L., University of Lorraine, France
patrice.berthod@univ-lorraine.fr

Jérémy Peultier, F.S.T., University of Lorraine, France
Valentin Kuhn, F.S.T., University of Lorraine, France
Thierry Schweitzer, I.J.L., University of Lorraine, France
Lionel Aranda, I.J.L., University of Lorraine, France

Key Words: cast superalloys, zirconium carbides, refractoriness, creep, H.T. oxidation.

Usually introduced in superalloys and other alloys for trapping impurities such as sulfur, zirconium can be used as carbide-former element to promote strengthening by MC carbides. This type of carbides, more usually issued from tantalum (TaC carbides), is known as being both very imbricated with matrix and very stable at high temperature, and consequently especially efficient for the reinforcement of alloys for high resistance to creep deformation at high temperature. ZrC are not or rarely used in this field and the purpose of this work is to test them in refractory cobalt-based and iron-based alloys.

Several Co-based and Fe-based alloys of the {M-25Cr-xC-yZr}-type ($x=0.25$ or 0.50 , $y=1$ or 2 , in wt.%) were elaborated by foundry and subjected to DTA control of their melting range, {1200°C, 20MPa}-flexural creep tests and oxidation in synthetic air at 1200°C. The microstructures are composed of a dendritic matrix and of a more or less dense interdendritic network of carbides, mainly composed of ZrC. These ones are effectively of a script-like shape and they obviously form a eutectic with the matrix. The obtained temperatures of melting start are generally very high. The creep resistance is interesting for the cobalt-based versions, but rather poor for the iron-based ones. The behavior of most alloys in high temperature oxidation needs to be significantly improved.



dendritic
matrix

script ZrC
carbides

Figure 1 – as-cast microstructure of one of the studied alloys (here: a Co-based one); SEM/BSE micrograph